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But, by the theory of equations, we get from (4)

$$\begin{aligned}
 a'a'' &= \frac{m^2 + 4ny^2}{4(mx + nx^2)}, \text{ and } a' + a'' = \frac{my + 2nxy}{mx + nx^2}; \therefore a'^2 + 2a'a'' + a''^2 \\
 &= \left(\frac{my + 2nxy}{mx + nx^2} \right)^2, \text{ and } (a' - a'')^2 = \left(\frac{my + 2nxy}{mx + nx^2} \right)^2 - \frac{m^2 + 4ny^2}{mx + nx^2} \\
 &= \frac{m^2y^2 - m^3x - m^2nx^2}{(mx + nx^2)^2}; \\
 \therefore t^2 &= \frac{m^2y^2 - m^3x - m^2nx^2}{(mx + nx^2)^2} \div \left[1 + \frac{m^2 + 4ny^2}{4(mx + nx^2)} \right] \\
 &= \frac{m^2y^2 - m^3x - m^2nx^2}{(mx + nx^2)^2} \div \left[\frac{4mx + 4nx^2 + m^2 + 4ny^2}{4(mx + nx^2)} \right] \\
 &= \frac{m^2(y^2 - mx - nx^2)}{(mx + nx^2)^2} \div \frac{(4mx + 4nx^2 + m^2 + 4ny^2)^2}{16(mx + nx^2)^2} \\
 &= \frac{16m^2(y^2 - mx - nx^2)}{(4mx + 4nx^2 + m^2 + 4ny^2)^2} \dots \dots \dots (6)
 \end{aligned}$$

the equation of the locus required.

If $t = \tan 90^\circ = \infty$, then $4mx + 4ny^2 + m^2 = 0 \dots \dots \dots (7)$
 the equation of a circle. If $n = 0$,

$$t^2 = \frac{16m^2(y^2 - mx)}{(4mx + m^2)^2} = \frac{16(y^2 - mx)}{(4x + m)^2}, \dots \dots \dots (8)$$

the equation of an hyperbola. If $t = \infty$ in (8), $4x + m = 0$, $x = -\frac{1}{4}m$,
 the equation of the directrix to the parabola.

CRELLE'S JOURNAL.

NOTE, by CHRISTINE LADD, Chelsea, Mass.—The last number of Crelle's *Journal for pure and applied Mathematics* opens with the continuation of an article by Stern on The Theory of Euler's Numbers.

Sturm contributes a paper of forty pages on Cubic Curves in Space. Six points in space determine such a curve. Through five fixed points, quadratic curves can be passed, through four points, biquadratic curves. The author proposes to determine how many curves of each of these two classes will cut a given line, how many will pass through a given point, how many be tangent to the line, how many cut a plane, how many osculate the plane, and how many will satisfy at once all possible combinations of these conditions. Alsatia shows its mathematical activity by a paper of Milinowski's

on A Reciprocal Relation of the Second Order. Given such a relation between three collinear systems; if a point or a line move according to a certain law in one system, according to what law will the corresponding point or line move in the other system? Mr Mallet of Trinity College, Dublin, furnishes the next paper. Richolot has shown that, if $R(x)$ represents a rational function of x and $X = (x - x_1)(x - x_2) \dots (x - x_{2m})$, in which x_1, x_2 &c. are real quantities, positive or negative, the integral

$$\int \frac{R(x)dx}{\sqrt{X}}$$

can be reduced, by a series of rational substitutions, to the normal form of hyperelliptic integrals. Mallet shows that the desired reduction can be effected by the union and repetition of only four substitutions. Th. Reye communicates an extension of a former article on Algebraic Surfaces apolar to each other. Cauchy and Abel have given a rule for the multiplication of two infinite converging series when the analytic moduli of the series are converging. F. Mertens, in the concluding paper of the number, shows that in order to the application of this rule, it is only necessary that the modulus of one of the series should be convergent.

It is not greatly to the credit of the mathematicians of the vicinity that Crelle's Journal lies on the shelves of the Boston Public Library with uncut leaves; unless, indeed, we are to suppose that all who give themselves to mathematics are so rich that they can afford to take the Journal for themselves. Certainly none who hope to extend the boundaries of the science can afford to do without their Crelle.

RECENT MATHEMATICAL PUBLICATIONS.

COMMUNICATED BY G. W. HILL.

Memoir on the Secular Variations of the Elements of the Orbits of the Eight Principal Planets. By John N. Stockwell, M. A. (Smithsonian Contributions to Knowledge. No. 232.) Washington, 1872. 4to. 200 pp. \$2.00.

An Investigation of the Orbit of Uranus, with General Tables of its Motion. By Simon Newcomb. (Smithsonian Contributions to Knowledge. No. 262.) Washington, 1872. 4to. 288 pp.

On the General Integrals of Planetary Motion. By Simon Newcomb. (Smithsonian Contributions to Knowledge. No. 281.) Washington, 1874. 4to. 31 pp.